

A biological survey of selected surface waters of Pine Mountain Wildlife Management Area

Introduction:

In 1997, as part of an effort by the ANR/FWD to characterize the biodiversity of Pine Mountain Wildlife Refuge, the fish and aquatic macroinvertebrate communities were surveyed on three reaches of two streams. The macroinvertebrate community from several other surface waters including one vernal pool, one spring seep, and a wetland beaver pond were also sampled. A limited amount of background water chemistry was also collected during the time of each biological sampling, to help characterize each waterbody type. This report characterizes the stream community types found on Pine Mtn and discusses their biological integrity compared to a set of reference level streams of similar type found in Vermont. The survey also represents a start at an inventory of the fish and aquatic macroinvertebrate species found within Pine Mtn.

Methods:

The fish community was sampled in the late summer using a backpack electro shocker. A representative reach of each stream was sampled in one pass. All fish were collected and the Brook Trout measured for total length.

The macroinvertebrate community of the streams were sampled in the late summer using a standardized timed kicknet method used by the VTDEC (VTDEC Field Methods Manual 1989). For high gradient streams samples are collected within a representative riffle habitat of the stream reach. Slow sand bottom streams are sampled using a similar level of effort with collections taken from both woody debris and the silt/sand bottom. More qualitative sweep samples were collected from a spring seep, vernal pool, and the littoral area of a wetland pond. Figure 1 shows the sampling locations.

Results and Discussion

Physical/Chemical:

Table 1 presents the physical/chemical attributes and water quality measures for the surface waters sampled in 1997. The two significant streams Keenan Brook and East Brook are small in size and drainage area, and mostly over 1000 ft in elevation. The three stream sites and the wetland pond all have pH and alkalinity values that are not limiting to the aquatic biota. The alkalinities range from 39 to 58 or in a moderate range for Vermont. Both streams originate off the property in wetland-beaver pond complexes. Their upper reaches are low in gradient (velocity 0.5ft/sec) with substrates dominated by sands and silt. Their lower reaches are higher in gradient (velocity 1.5ft/sec) with substrates dominated by boulder/cobble/gravel. East Brook does however continue to carry a relatively high sand bedload resulting in a high percent embeddedness of the cobble substrate. Both support a Diatom, and moss dominated periphyton community in their lower reaches typical for small full canopied streams in Vermont.

Table 1: Some physical/chemical attributes of the surface waters of Pine Mtn Wildlife Management Area 1997, Topsham, Vt.

	Keenan Brk 1.4	East.Brk 1.4	East.Brk 2.6	Dawes Brk X	Vernal pool 1	Whitche r Trib 0.2	Wetland Pond 1.3
Date	9/9/97	9/9/97	9/9/97	9/9/97	6/12/97	6/12/97	6/12/97
D.Area km ²	10.7	4.9	2.1	.75	.1	.1	.5
Elev. ft	980	1020	1220	1080	1235	1120	1095
pH	7.68	6.47 7.19	8.12	6.63	6.50		6.94
Alk mg/l	39	45	58	34.5	20.3		
Cond	93	102	130	85.9	48.8		70.7
color	60	60	55				
Ca mg/l		18.1			7.08		12.2
Na mg/l		1.84			1.12		1.1
%Boulder	35	25	0				
%cobble	30	25	0				
%C.Gr	20	20	0				
%Gr	10	15	0				
%Sand	5	15	80				
%Silt	0	0	20				
%Embed	5-25	50-75	na				
%Dia	100	100	na				
%Moss	10	25	na				
%Canopy	100	100	70				
Vel. ft/sec	1.5	1.5	.5				

A limited amount of water chemistry was collected on the minor water bodies and the wetland pond. The pH and alkalinity on Dawes Brook a small spring seep at the point of sampling shows that it is similar to that larger streams with a moderate pH (6.63) and alkalinity (34.5). Whitcher Trib. Was not sampled but drains the wetland pond and therefore probably has a similar pH and Alkalinity to the pond which was also in the moderate range. The vernal pool had the lowest pH and alkalinity of all the waters sampled at 6.5 and 20.3. These are still considered as being of a moderate level and would not be limiting to most aquatic life.

Macroinvertebrate Community:

The macroinvertebrate community metrics, percent composition of the orders, and the functional feeding group composition is presented in **table 2** for the three stream sites sampled on Keenan and East Brook. A list of all taxa collected from all sites are presented as appendixes. The macroinvertebrate community composition shows that there are **two stream macroinvertebrate community types** along segments of both these major streams in the PMWMA see attached map. The lower portions of both brooks support a **high gradient alkaline small stream** community (represented by Keenan Brk 1.4, and East Brk 1.4), while the upper portions of these streams support a **low gradient alkaline small stream community**, (represented by East Brook 2.6). The major environmental difference between these stream communities is gradient resulting in a cobble/boulder dominated streambed in the lower reaches and a sand/silt dominated streambed in the upper reaches.

The VTDEC has an extensive database of reference quality streams (see table 2 Ref stream type 2) that can be used to evaluate the biological integrity of the high gradient portions of each stream on both brooks. The biological integrity of a community generally reflects the overall water and habitat quality of a stream.

Keenan Brooks biological integrity is fair to good with a **very low overall density** and several community metrics and compositional traits that are outside the range of the regional reference stream data set. The biometrics presented in **table 2** show that Keenan brook has a comparable EPT richness and EPT/Richness ratio, and EPT/EPT&C ratio to that of the reference data set. In fact the last two ratios are actually on the very high end of excellent. The overall richness is slightly lower than that of our reference streams, and the Bio Index value shows a slight enrichment compared to the reference condition. Both of these deviations are only slight and show the community to be good overall. The density of animals in the brook however is considerably low and indicates that perhaps the habitat quality is limiting the streams productivity. The habitat assessment does show some sand and cobble embeddedness exists in the stream, however not to the extent that we typically see it limiting macroinvertebrate densities. Other natural factors that can cause low densities are scour from flood level flows, which I don't believe occurred in the previous two months, or perhaps the extremely dense overhead canopy of softwoods that could conceivably be limiting primary production (algal growth) in the stream and limiting the input of leaf litter also a primary food source of macroinvertebrates. The functional group composition does show that there are no algal shredding herbivores and the detritivore shredders are also low for the stream type. The order level percent composition is slightly different from the reference streams with a low percentage of Plecoptera and Diptera and a higher

percentage of Coleoptera and Ephemeroptera.

Lower **East Brooks biological integrity is fair to good** compared to other reference quality streams. The Bio Index is slightly high indicating low levels of enrichment. The low EPT value, EPT/Richness ratio, and percent composition of the taxonomic orders and functional group composition are all outside the range of the regional reference stream data set for the stream type (see table 2). The low EPT value could be due to the high amount of sand in the brook, embedding the substrate and limiting the available habitat for macroinvertebrates. Normally this also causes low densities of animals, however the high percent moss cover on the cobble substrate increases the available habitat for certain species offsetting the loss interstitial cobble space. The Coleoptera *Oulimnius latiusculus*, *Promoresia tardella* and the Ephemeroptera *Leptophelibiidae*, and *Baetis spp* especially are known to colonize moss's. As a result the percent Coleoptera in the community is abnormally high and the percent Diptera, and Trichoptera abnormally low for the stream type.

Fish Community:

The fish community of both streams is comprised only of brook trout. While an assemblage of only brook trout is not unusual for coldwater streams of this size, the density of trout in both streams is atypically low. The density for both brooks was 5/100m², a standing crop of brook trout more typical of acid stressed streams with alkalinities below 5mg/l. The only observable habitat factor that may be effecting the standing crop is the high proportion of sand in the substrate, which may limit the density and kinds of invertebrates available as a food source. Both communities contained young of the year indicating successful reproduction.

Macroinvertebrate taxa from other aquatic habitats:

The macroinvertebrate taxa found in these other aquatic habitats is presented in Appendices 4-6. The vernal pool contained only six species, including the bivalve *Musculium partumeium*. The community was dominated by the Diptera Chironomidae *Larsia sp.*, a predacious midge larvae. A total of sixteen taxa were identified from the intermittent tributary to Whitcher brook. These included two gastropods *Fossaria modicella* and *Aplexa elongata*, and one bivalve *Pisidium sp.* Also represented were four Coleoptera species, seven Diptera, and one Plecoptera and Ephemeroptera. The wetland beaver pond collection contained the most taxa at twentyone, representing eleven different orders. The dominant taxa included four bivalvia species, *Musculium securis*, *Pissidium casertanum*, *P. punctatum*, and *Sphaerium rhomboideum*, and two gastropods *Helisoma anceps* and *Promenetus exacuus*. Also dominant were the amphipod *Hyalalella azteca*, the Coleoptera *Dineutes assimilis*, and *Hydroporus sp.*, the Diptera *Procladius sp.*, the Ephemeroptera *Caenis sp.*, and the Hirudinea *Oligobdella biannulata*. The high number of crustacea and mollusca taxa and their dominance in the communities of these aquatic habitats is attributable to the high alkalinity and Calcium levels in the water.

Table 2: Macroinvertebrate Community metrics, percent composition of the orders and functional groups from three stream reaches on two streams in the Pine Mtn Wildlife Managment Area. Also included is the expected biological metric range from other Str type 2 reference streams in Vt (VTDEC) .

	Keenan Brk 1.4	East Brk 1.4	Ref Median Str Type 2 (25-75 %)	East Brk 2.6
Density	201	1580	878 (681-1473)	665
Richness	31	36	40 (35-44)	48
EPT	20	16	23.5 (20-24)	8
EPT/Richness	.65	.44	.58 (.53-.59)	.17
#EPT/EPT&c	.98	.91	.88 (.82-.93)	.43
BioIndex	1.78	1.82	1.29 (1.08-1.51)	2.99
%Coleoptera	10	29	4 (0.8-6.0)	1
%Diptera	10	8	16 (12-21)	38
%Ephemeroptera	36	27	20 (14-32)	17
%Plecoptera	16	28	29 (21-44)	6
%Trichoptera	25	5	18 (14-29)	0
%Odonata	1	1		7
%Oligocheata	1	1	<1 (0-0.3)	<1
%Bivalvia	0	0		27
Other	0	0	<1 (0.1-0.5)	2
%Col.Gath.	35	22	26 (21-42)	23
%Col.Filt.	23	26	18 (13-26)	31
%Predator	22	9	20 (13-27)	34
%Shrd-det	4	3	14 (10-16)	1
%Shrd-herb	0	0	<1 (0-2)	2
%Scraper	12	29	8 (4-15)	1
Comm Eval	fair	fair	Excellent	good?

Appendix 1: The macroinvertebrate taxa from East Brook (lower)1.4.

Order	Genera	Species	Density	% Comp
COLEOPTERA	OPTIOSERVUS	sp	12	0.76
COLEOPTERA	OPTIOSERVUS	ovalis	8	0.51
COLEOPTERA	OULIMNIUS	latiusculus	184	11.65
COLEOPTERA	PROMORESIA	tardella	184	11.65
COLEOPTERA	STENELMIS	crenata	8	0.51
COLEOPTERA	ECTOPRIA	leechi	64	4.05
DIPTERA	ATHERIX	sp	4	0.25
DIPTERA	BRILLIA	sp	4	0.25
DIPTERA	PARAMETRIOCNEMUS	sp	4	0.25
DIPTERA	POTTHASTIA	longimana	4	0.25
DIPTERA	STENOCHIRONOMUS	sp	4	0.25
DIPTERA	TVETENIA	bavarica	32	2.03
DIPTERA	MICROPSECTRA	sp	12	0.76
DIPTERA	LOPESCLADIUS	sp	28	1.77
DIPTERA	EMPIDIDAE	unid	4	0.25
DIPTERA	SIMULIUM	tubersom	20	1.27
DIPTERA	DICRANOTA	sp	8	0.51
EPHEMEROPTERA	BAETIDAE	unid	12	0.76
EPHEMEROPTERA	BAETIS	sp	124	7.85
EPHEMEROPTERA	BAETIS	tricaudatus	48	3.04
EPHEMEROPTERA	EPHEMERELLA	sp	60	3.80
EPHEMEROPTERA	HEPTAGENIIDAE	unid	12	0.76
EPHEMEROPTERA	LEPTOPHLEBIIDAE	unid	164	10.38
TRICHOPTERA	SYMPHITOPSYCHE	sp	44	2.78
TRICHOPTERA	SYMPHITOPSYCHE	alhedra	36	2.28
TRICHOPTERA	SYMPHITOPSYCHE	slossonae	32	2.03
TRICHOPTERA	SYMPHITOPSYCHE	sparna	124	7.85
TRICHOPTERA	LEPIDOSTOMA	sp	24	1.52
TRICHOPTERA	DOLOPHIODES	sp	160	10.13
TRICHOPTERA	RHYACOPHILA	fuscula	16	1.01
TRICHOPTERA	RHYACOPHILA	carolina	8	0.51
PLECOPTERA	CHLOROPERLIDAE	unid	4	0.25
PLECOPTERA	LEUCTRIDAE	unid	16	1.01
PLECOPTERA	AGNETINA	capitata	12	0.76
PLECOPTERA	ISOPERLA	sp	44	2.78
ODONATA	BOYERIA	sp	0	0.00
ODONATA	CORDULEGASTER	maculatus	0	0.00
ODONATA	LANTHUS	sp	20	1.27
OLIGOCHAETA	ENCHYTRAEIDAE	unid	16	1.01
HYDRACHNIDIA	RHYNOLIMOCHARES	sp	12	0.76
HEMIPTERA	RHAGOVELIA	sp	8	0.51

Appendix 2: The macroinvertebrate taxa from East Brook (upper) 2.6.

Order	Genera	Species	Density	% Comp
COLEOPTERA	OPTIOSERVUS	sp	2.4	0.36
COLEOPTERA	OULIMNIUS	latusculus	2.4	0.36
COLEOPTERA	CRENITIS	digesta	2.4	0.36
DIPTERA	BEZZIA	sp	7.2	1.08
DIPTERA	CULICOIDES	sp	4.8	0.72
DIPTERA	ABLABESMYIA	sp	2.4	0.36
DIPTERA	CLINOTANYPUS	sp	2.4	0.36
DIPTERA	CRICOTOPUS	bisinctus	2.4	0.36
DIPTERA	CRICOTOPUS	intersectus	4.8	0.72
DIPTERA	CRICOTOPUS	trifascia	7.2	1.08
DIPTERA	EPOICOCADIUS	sp	2.4	0.36
DIPTERA	HETEROTRISOCADIUS	sp	2.4	0.36
DIPTERA	MACROPELOPIA	sp	45.6	6.86
DIPTERA	NANOCLADIUS	sp	7.2	1.08
DIPTERA	PARAMETRIOCNEMUS	sp	43.2	6.50
DIPTERA	POLYPEDILUM	illionoense	2.4	0.36
DIPTERA	PROCLADIUS	sp	9.6	1.44
DIPTERA	RHEOTANYTARSUS	sp	2.4	0.36
DIPTERA	STEMPELLINELLA	sp	2.4	0.36
DIPTERA	TANYTARSUS	sp	9.6	1.44
DIPTERA	THIENEMANNEMYIA	sp	57.6	8.66
DIPTERA	ZAVRELIMYIA	sp	2.4	0.36
DIPTERA	SYMPOSIOCADIUS	sp	2.4	0.36
DIPTERA	PAGASTIELLA	sp	2.4	0.36
DIPTERA	SIMULIUM	tubersom	2.4	0.36
DIPTERA	CHRYSOPS	sp	19.2	2.89
DIPTERA	PSEUDOLIMNOPHILA	sp	4.8	0.72
DIPTERA	TIPULA	sp	2.4	0.36
EPHEMEROPTERA	BAETIDAE	unid	28.8	4.33
EPHEMEROPTERA	BAETIS	sp	9.6	1.44
EPHEMEROPTERA	EURYLOPHELLA	funeralis	2.4	0.36
EPHEMEROPTERA	LITOBANCHA	sp	28.8	4.33
EPHEMEROPTERA	LEPTOPHLEBIIDAE	unid	45.6	6.86
TRICHOPTERA	ANABOLIA	sp	2.4	0.36
TRICHOPTERA	PTILOSTOMIS	sp	4.8	0.72
TRICHOPTERA	PHYLOCENTROPUS	sp	9.6	1.44
TRICHOPTERA	POLYCENTROPUS	sp	26.4	3.97
ODONATA	AESHNA	sp	2.4	0.36
ODONATA	CALOPTERYX	sp	2.4	0.36
ODONATA	CORDULEGASTER	sp	28.8	4.33
ODONATA	SOMATOCHLORA	sp	2.4	0.36
ODONATA	LANTHUS	sp	9.6	1.44
MEGALOPTERA	SIALIS	sp	12	1.81
GASTROPODA	PHYSA	sp	2.4	0.36
BIVALVIA	PISIDIUM	casertanum	177.6	26.71
BIVALVIA	PISIDIUM	sp a	2.4	0.36
BIVALVIA	PISIDIUM	sp b	2.4	0.36
OLIGOCHAETA	LUMBRICULIDAE	unid	2.4	0.36

Order	Genera	Species	Density	% Comp
HYDRACHNIDIA	NEOLIMNOCHARES	sp	2.4	0.36

Appendix 3: The macroinvertebrate taxa from Keenan Brook 1.4.

Order	Genera	Species	Density	% Comp
COLEOPTERA	OPTIOSERVUS	sp	1	0.50
COLEOPTERA	OPTIOSERVUS	ovalis	1	0.50
COLEOPTERA	ECTOPRIA	leechi	18	8.96
DIPTERA	ATHERIX	sp	3	1.49
DIPTERA	PARAMETRIOCNEMUS	sp	1	0.50
DIPTERA	THIENEMANNIELLA	sp	1	0.50
DIPTERA	MICROPSECTRA	sp	2	1.00
DIPTERA	SIMULIUM	tubersom	8	3.98
DIPTERA	ANTOCHA	sp	1	0.50
DIPTERA	DICRANOTA	sp	3	1.49
EPHEMEROPTER A	BAETIDAE	imm	7	3.48
EPHEMEROPTER A	BAETIS	flavistriga	4	1.99
EPHEMEROPTER A	BAETIS	intercalaris	16	7.96
EPHEMEROPTER A	BAETIS	tricaudatus	21	10.45
EPHEMEROPTER A	ACENTRELLA	sp	1	0.50
EPHEMEROPTER A	EPHEMERELLIDAE	imm	8	3.98
EPHEMEROPTER A	EPHEMERELLA	subvaria	10	4.98
EPHEMEROPTER A	EPEORUS	sp	5	2.49
EPHEMEROPTER A	STENONEMA	sp	1	0.50
TRICHOPTERA	GLOSSOSOMA	sp	3	1.49
TRICHOPTERA	CHEUMATOPSYCHE	sp	3	1.49
TRICHOPTERA	SYMPHITOPSYCHE	slossonae	9	4.48
TRICHOPTERA	SYMPHITOPSYCHE	sparna	6	2.99
TRICHOPTERA	LEPIDOSTOMA	sp	2	1.00
TRICHOPTERA	DOLOPHILODES	sp	20	9.95
TRICHOPTERA	RHYACOPHILA	minora	2	1.00
TRICHOPTERA	RHYACOPHILA	carpenteri	6	2.99
PLECOPTERA	CHLOROPERLIDAE	unid	2	1.00
PLECOPTERA	LEUCTRIDAE	unid	4	1.99
PLECOPTERA	PARAGNETINA	sp	14	6.97
PLECOPTERA	PARAGNETINA	immarginata	9	4.48
PLECOPTERA	AGNETINA	capitata	3	1.49
PLECOPTERA	PTERONARCYS	sp	1	0.50
ODONATA	LANTHUS	sp	3	1.49
OLIGOCHAETA	ENCHYTRAEIDAE	unid	2	1.00

Appendix 4: Macroinvertebrate taxa from Vernal pool at Pine Mountain Wildlife management area.

Order	Genera	Species	Density	% Comp
COLEOPTERA	ACILIUS	sp	2	6.45
DIPTERA	MOCHLONYX	cinctipes	1	3.23
DIPTERA	CHIRONOMUS	sp	2	6.45
DIPTERA	LARSIA	sp	19	61.29
BIVALVIA	MUSCULIUM	partumeium	6	19.35
HYDRACHNIDIA	THYAS	sp	1	3.23

Appendix 5: Macroinvertebrate taxa from Witcher Brook Tributary a small intermittent stream.

Order	Genera	Species	Density	% Comp
COLEOPTERA	AGABUS	obtusatus	1	1.28
COLEOPTERA	CRENITIS	monticola	1	1.28
COLEOPTERA	HELOCOMBUS	bifidatus	1	1.28
COLEOPTERA	PRIONOCYPHON	sp	1	1.28
DIPTERA	CHIRONOMUS	plumosus grp	1	1.28
DIPTERA	DIAMESA	sp	1	1.28
DIPTERA	HETEROTRISSOCLADIUS	sp	1	1.28
DIPTERA	LARSIA	sp	1	1.28
DIPTERA	TANYTARSUS	sp	6	7.69
DIPTERA	THIENEMANNEMYIA	sp	1	1.28
DIPTERA	PEDICIA	sp	1	1.28
EPHEMEROPTERA	SIPHONURUS	sp	8	10.26
PLECOPTERA	LEUCTRIDAE	unid	2	2.56
GASTROPODA	FOSSARIA	modicella	4	5.13
GASTROPODA	APLEXA	elongata	23	29.49
BIVALVIA	PISIDIUM	sp	25	32.05

Appendix 6: Macroinvertebrate taxa from a wetland beaver pond at Pine Mountain Wildlife Management area.

Order	Genera	Species	Density	% Comp
COLEOPTERA	DINEUTES	assimilis	6	5.17
COLEOPTERA	HYDROPORUS	sp	4	3.45
DIPTERA	PROCLADIUS	sp	4	3.45
DIPTERA	TANYTARSUS	sp	2	1.72
EPHEMEROPTERA	CAENIS	sp	8	6.90
TRICHOPTERA	POLYCENTROPUS	sp	1	0.86
ODONATA	COENAGRIONIDAE	unid	1	0.86
ODONATA	LADONA	sp	1	0.86
AMPHIPODA	HYALLELA	azteca	10	8.62
GASTROPODA	HELISOMA	anceps	3	2.59
GASTROPODA	PROMENETUS	exacuous	4	3.45
BIVALVIA	MUSCULIUM	securis	17	14.66
BIVALVIA	PISIDIUM	casertanum	15	12.93
BIVALVIA	PISIDIUM	punctatum	20	17.24
BIVALVIA	SPHAERIUM	rhomboideum	9	7.76
OLIGOCHAETA	LUMBRICULIDAE	unid	2	1.72
HIRUDINEA	GLOSSIPHONIA	complanata	1	0.86
HIRUDINEA	OLIGOBDELLA	biannulata	4	3.45
HIRUDINEA	NEPHELOPSIS	obscura	1	0.86
HEMIPTERA	SIGARA	sp	1	0.86

Order	Genera	Species	Density	% Comp
HEMIPTERA	NOTONECTA	sp	2	1.72

